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High Phase Order Electrical Rotating Machine with Distributed Windings

Technical Field

The present invention relates to winding distributions in rotating electrical
5 machines.

Background Art

Previously disclosed, in application number 09/255,291 and in U.S. Patent No.
6,351,095, have been High Phase Order electrical rotating machine designs.

Of specific interest is the application "HIGH PHASE ORDER MOTOR WITH MESH
10 CONNECTED WINDINGS," 09/713,654, filed November 15, 2000, ^{now Patent Number 6,657,334,} which discloses the
use of a high phase order concentrated winding machine, connected to an
inverter using a mesh connection. When using a mesh connection, the voltage
across each winding is a function related to the voltages of both of the two
inverter legs that drive that winding, and therefore, may be different from
15 the actual voltages produced by the inverter legs. That machine is
deliberately operated either with a fundamental drive waveform, a pure
harmonic drive waveform, or admixtures of these, in order to change the
volts/hertz ratio of an induction machine, in order to increase the power
delivered to the machine by a power electronics drive system when the motor
20 was being operated at low speed and thus reduced slot voltage. In other
words, the motor can be operated at higher current than the currents produced
in the inverter.

In my previously disclosed machines, extensive use was made of concentrated
windings. Concentrated windings place inductors of a single phase in a
25 single slot in each pole of a stator. Motor windings are usually produced
using coils of wire, with the portion of a coil residing in one slot forming
the inductors for that slot, and the portion of the same coil on the opposite
side of the coil is placed in another slot, forming a set of inductors with
reverse polarity from the first. These two slots are placed 180 electrical
30 degrees apart, forming so-called full span concentrated windings.

Concentrated windings offer numerous benefits, including the ability to use
harmonic components of drive currents to produce useable rotating fields,
reduction in chording and distribution factors, which reduce resistance
losses, and the ability to use specific harmonic drive waveforms to obtain
35 desired changes in machine impedance. However the use of concentrated